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WITNESS my hand this
Fifteenth day of March 2005

A handwritten signature in dark ink, appearing to read 'J. Peisker'.

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AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED

**"METHOD AND APPARATUS FOR SOCKING SEED MOLLUSCS
AND/OR FOR APPLYING SUPPORT DEVICES TO MOLLUSC
GROWING LINES"**

This invention is described in the following statement:-

The present invention relates to a method and apparatus for use in the aquaculture farming industry, and relates particularly, though not exclusively to a method and apparatus for socking seed or juvenile molluscs, especially mussels, and/or for applying support devices to growing lines prior to the growing lines being suspended in a growing environment.

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With increased demand for high quality produce, the aquaculture farming industry has developed smarter and more reliable techniques for culturing and harvesting marine life. Mussels, like other marine life, were historically harvested from the wild. However, as stocks diminished, new methods of farming mussels have evolved. A common mussel farming method utilises growing lines, such as ropes, nets, or the like, which are suspended below the surface of the water in order to collect seed mussels, which attach themselves to the lines in order to grow. After some time seed mussels collect on these lines in dense clusters, in fact at a density which is too large to permit the mussels to mature properly. At this point a mussel farmer may withdraw the lines from the water for harvesting and may then manually, separate, de-clump, grade and inject the immature mussels into a mesh sock, net or the like which usually surrounds a growing line.

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A traditional method of injecting seed mussels into a mesh sock involves the use of a tubular applicator, which is commonly a section of plastic tube having a suitable internal diameter. In use, a mesh sock is manually stretched and applied onto the outer surface of the tube, a free end of the sock is then drawn off one end of the tube and tied ready for injection with seed mussels. The mussels are injected into the sock through the tube, at the open end thereof, opposite the end where the sock was tied. The process of socking the mussels continues as the tied end of the sock is manually drawn away from the applicator, pulling more sock off the outer surface of the tube, which in turn is filled with injected seed mussels. This process facilitates mussel attachment at a more appropriate density to assist the growth of mussels when they are re-introduced into the water. The mussel density within the sock is determined by the internal diameter of the tubular applicator used during the injection process. As the internal diameter of an applicator is fixed, many applicators with varying internal diameters are generally used by a mussel farmer in order to achieve varying mussel density requirements. Due to the varying density requirements, the process of socking seed mussels has to date only been a manual process.

The use of a mesh sock, which is sometimes perishable, provides a greater surface area for the mussels to attach to as they grow. Over time, mussels grow radially outwardly through the sock, to a size which can be several inches long. As mussels increase in size, those closest to the growing line rely on support from the growing line itself, by attaching themselves thereto, whilst those disposed radially outwardly thereof rely on attachment to other mussels below them for support. If a mesh sock is utilised, mussels in the vicinity thereof can rely on this sock for support. If the sock is perishable, mussels can only initially rely on the sock for support. After the sock disintegrates, mussels in that vicinity can only rely on support from those mussels beneath them. It is at this point that the entire mussel crop is reliant on the foothold of those mussels (the supporting mussels) that have directly attached themselves to the growing line. The number of mussels that can actually attach themselves directly to a growing line is dependant on the diameter or surface area of the growing line itself. It thus becomes evident that, as mussels grow and hence weight increases, if supporting mussels lose their foothold significant losses of crop can occur as large clusters of mussels fall away from the growing line and are lost.

Losses associated with mussels peeling off or falling away from growing lines will hereinafter generally be referred to as the "slide off effect".

To minimise losses associated with the slide off effect many methods have been employed in the past. One such method has been to provide additional support to mussels on a growing line, through the insertion of a series of skewers or rods. These skewers, usually wooden, are manually inserted at spaced intervals through the mesh sock or net after the socking process, between the mussels and through the core growing rope (which provides the secure attachment). This results in a series of protrusions extending horizontally from either side of the vertically suspended growing line. These protrusions assist in supporting mussels from slide off by providing a greater attachment area for the mussels, being supported directly in the vicinity of the skewers.

An alternate method for providing additional support to mussels as they grow is described in US Patent No. 6,520,116, of Jefferds, Ian W, and an embodiment of the same can be seen in Figs. 7a & 7b of the accompanying representations. This method utilises a planar support plate or disc which is adapted to provide a large horizontal support surface for mussels to attach to when the support is attached to a growing line. These plates or discs

have a slot for receiving a growing line and a skewer-like projection attached thereto, projecting into and parallel with the slot, to be inserted through the growing line to facilitate attachment thereto. These plates rely on known skewer principles, in that they utilise a skewer for attachment to a growing line. Where these plates differ from the traditional skewer is that the additional support is provided by way of a plate making up one of the horizontal protrusions, instead of both protrusions simply being respective protruding sides of a skewer.

A problem associated with the skewer method, or with devices which utilise a skewer for attachment to a growing line, such as Jefferds, is that the application of a skewer to a growing line has traditionally been a manual process. Due to the nature of the insertion of a skewer through a growing line an automated application process is generally considered not possible. In cases where a mesh sock is used in combination with a growing rope, before attempting to apply a skewer it is required to find an encased, sometimes visually hidden and, more often than not, growing rope that is not centrally located within the sock. The skewer then needs to be inserted through the rope, preferably centrally and horizontally to the rope. Thus this task is usually performed manually after the socking operation and the aim of central and horizontal insertion is not always easy to achieve.

An alternate method of attaching plate-like support structures to growing lines is described in US Patent No. 6,578,523, of Gagnon, Gilles, and an embodiment of the same can be seen in Figs. 6a & 6b of the accompanying representations. Instead of using a skewer-like projection for attachment Gagnon provides a device which utilises a clip arranged within an aperture, at the centre of the device, to facilitate attachment of the device to a growing line. This clip is cylindrical in shape and, in use, has a diameter slightly smaller than the diameter of the growing line for gripping the latter when attached thereto. The clip has an opening bordered by outwardly diverging, resilient arms. During insertion of a growing line the arms flex outwardly into generally V-shaped recesses and return to the rest position in which the rope is clamped in the clip. This device overcomes the problems associated with having to skewer a growing line, and instead proposes the use of a clip that resiliently clamps around the circumference of a growing line to provide attachment. However, the design of the clip is such that mussels have to be first parted or removed from the growing line in order to affix the device to an exposed section thereon. If the clip is not secured around an unhindered line attachment cannot occur, since the diameter of the

clip is smaller than the diameter of the growing line. If the growing line utilises a mesh sock in combination with a growing rope, then the growing rope must be located within the mesh sock and the mesh sock gathered around the rope prior to attaching the device. Due to the steps involved in attaching such a device to a growing line these devices on their own do not lend themselves to an automated application process.

An aquaculture support device having improved attachment means for attachment to many different growing line arrangements is disclosed in Australian Patent Application No. 2003904988. This application is an earlier application of the present Applicant and is incorporated herein in its entirety. Disclosed in this earlier application are a number of support devices each utilising at least one novel inwardly tapered slot used as an attachment means. The inwardly tapered slot being adapted to receive a growing line and, in use, to wedge the growing line between opposed sides of the slot to facilitate attachment of a device to the growing line. Due to the design of the slot of these devices, as growing lines are introduced into the tapered slot and moved inwardly relative thereto, mussel separation occurs and the taper locates the growing line and facilitates attachment of the device to the same. If a device incorporating the inwardly tapered slot is used with a growing line that is either a mesh sock or a mesh sock applied over a growing rope, the taper attachment of the device facilitates net compression, mussel separation and (if a rope is also used) location of the growing rope within the mesh sock. Thus, in cases where a rope is socked with a mesh net, it is not necessary to first locate the internal rope (which is sometimes hidden) to provide the desired attachment, as the taper will ensure that the rope is located and that the mesh sock is compressed around the rope as force is applied. These devices therefore lend themselves to an automated application process.

In order to automate the application process of these or other support devices onto growing lines, an application machine needs to be able to address a number of issues of which the following are noted. A socked growing line is not always socked uniformly, ie. the diameter of the socked line can vary from one point to another which makes attachment of some devices difficult. The core growing rope within the sock is not usually centrally located and is generally visually hidden making it difficult to attach some devices to the rope as discussed above. Lastly, perishable nets can easily tear or ladder rendering them useless and in need of repair or replacement. Therefore, before mechanical application of these or other support devices can occur one or more of the following tasks must be

achieved. Namely, the core growing line must be grabbed and held precisely in position or conveyed to a precise position and then grabbed and held firm ready for attachment of a device. In some cases for attachment to occur, seed mussels must be parted to provide an unhindered section of the growing line to facilitate attachment of a support device at a given location on the growing line. If a mesh sock is used on its own, or is used in combination with an internal growing rope, sock compression around the growing rope may be required simultaneously with the action of parting the mussels attached to the line to facilitate attachment of some devices.

10 It is therefore an object of the present invention to provide a method and apparatus for socking seed molluscs or the like into growing lines used for cultivation.

A further object of the present invention is to provide a method and apparatus for applying support devices to growing lines used for cultivating molluscs or the like

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Yet a further object of the present invention is to provide a method and apparatus for socking seed molluscs or the like into growing lines and for applying support devices to these growing lines after the same are produced.

20 With these objects in view the present invention in one aspect may provide an apparatus for socking molluscs, in use, to produce at least one elongate mollusc growing line, said apparatus including: means for supplying at least one elongate sock for injection with molluscs; means for injecting said molluscs into said at least one elongate sock; and means for driving said at least one elongate sock through said apparatus; wherein, in use, said
25 injecting means continually socks said molluscs into said at least one elongate sock as the same is conveyed by said driving means to produce said at least one elongate mollusc growing line.

30 Preferably said apparatus further includes means for supplying at least one elongate line into said at least one elongate sock simultaneously with the injection of said molluscs by said injection means, wherein said at least one elongate mollusc growing line produced by said apparatus consists of said at least one elongate sock having said injected molluscs and said at least one elongate line socked therein. It is also preferred that said means for supplying said at least one elongate sock is releasably attached to said apparatus to

facilitate ease of application of said at least one elongate sock to said at least one elongate sock supplying means.

5 In a practical preferred embodiment said means for supplying said at least one elongate sock is at least one socking applicator including an outer tubular body onto which said at least one elongate sock is loaded, and at least one tubular insert body having a smaller diameter to that of said outer body. Said at least one insert body being removably housed within said outer body and, in use, is adapted to receive within an inner surface thereof said at least one elongate sock ready for injection with said molluscs by said injecting means.

10 Said at least one insert body providing a density of said molluscs within said at least one elongate mollusc growing line relative to the internal diameter of said inner surface of said at least one insert body. Said at least one socking applicator capable of providing different mollusc densities within said at least one elongate mollusc growing line by introducing into said at least one socking applicator an insert with a suitable internal diameter.

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In a further practical preferred embodiment said injecting means includes at least one hopper for receiving said molluscs, said at least one hopper having at least one opening therein, each opening cooperating with at least one conveyor means, wherein, in use, said at least one conveyor means is adapted to feed said molluscs from within said at least one

20 hopper, through said at least one opening and into said at least one socking applicator. It is preferred that said molluscs are fed to said at least one socking applicator via at least one funnel. Said at least one funnel being adapted to receive said molluscs from said at least one hopper and, in use, to supply the same to said at least one socking applicator.

25 It yet a further practical preferred embodiment said driving means is at least one drive wheel that is adapted to engage and draw said at least one elongate sock and said at least one elongate mollusc growing line through said at least one socking applicator to, in use, facilitate the continual forming of said at least one elongate mollusc growing line. It is preferred that said at least one drive wheel cooperates with at least one guide wheel

30 capable of assisting said drawing of said at least one elongate mollusc growing line whilst the same is formed. It is further preferred that said at least one drive wheel includes paired upwardly projecting ridged arranged around the outer periphery of said at least one drive wheel. Said paired ridges defining a V-shaped recess between respective pairs that is adapted to accommodate growing lines of varying diameters. Said V-shaped recess

providing said at least one drive wheel with a means of engaging and driving elongate growing lines of varying diameters. In a practical embodiment, said paired ridges include tapered faces in the direction of travel of said at least one drive wheel to assist said at least one drive wheel in grabbing and engaging said at least one mollusc growing line to drive the same through said apparatus.

In a further aspect the present invention may also provide an apparatus for attaching at least one support device to at least one elongate mollusc growing line, said apparatus including: means for supplying said at least one elongate mollusc growing line; means for providing said at least one support device for attachment to said at least one elongate mollusc growing line; means for releasably holding said at least one elongate mollusc growing line at a predefined location; and means for applying said at least one support device to said at least one elongate mollusc growing line whilst said at least one elongate mollusc growing line is held by said releasable holding means.

Preferably said at least one elongate mollusc growing line is selected from one or more of the following: any suitable growing rope, any suitable growing rope that is socked with a suitable mesh sock, and/or any suitable mesh sock.

In a practical preferred embodiment said at least one elongate mollusc growing line consists of an elongate mesh sock which has been socked with molluscs and contains an elongate core growing rope.

Preferably said means for supplying said at least one elongate mollusc growing line includes at least one drive wheel that is adapted to engage and draw said at least one elongate mollusc growing line through said apparatus. It is preferred that said at least one drive wheel cooperates with at least one guide wheel capable of assisting said drawing of said at least one elongate mollusc growing line whilst the same is drawn through said apparatus. It is further preferred that said at least one drive wheel includes paired upwardly projecting ridged arranged around the outer periphery of said at least one drive wheel. Said paired ridges defining a V-shaped recess between respective pairs that is adapted to accommodate growing lines of varying diameters. Said V-shaped recess providing said at least one drive wheel with a means of engaging and driving elongate growing lines of varying diameters. In a practical embodiment, said paired ridges include

tapered faces in the direction of travel of said at least one drive wheel to assist said at least one drive wheel in grabbing and engaging said at least one mollusc growing line to drive the same through said apparatus.

- 5 In a practical preferred embodiment said means for providing said at least one support device includes at least one slide which cooperates with said support device applying means, wherein said at least one support device is loaded into said at least one slide ready for application by said support device applying means. It is preferred that said at least one slide is adapted to facilitate the supply of one support device at a time to said support
- 10 device applying means. Said support devices being supplied in a queue to said support device applying means ready for application. In a further practical embodiment said at least one slide is adapted to receive at least one weight, said at least one weight being loaded into said at least one slide after said at least one support device in order to drive said at least one support device to said support device applying means. In a further preferred
- 15 embodiment more than one support device is loaded onto said at least one slide in a cartridge form.

- In a further practical embodiment said means for releasably holding said at least one elongate mollusc growing line includes at least one set of mating jaws adapted to be drawn
- 20 into engagement with one another in order to grab and releasably hold said at least one elongate mollusc growing line. Preferably said at least one set of mating jaws include V-shaped opposed peripheral mating surfaces that, in use, engage and compress said at least one elongate mollusc growing line to facilitate simultaneous mollusc parting about said jaws, mesh sock compressing relative said core growing rope and location of said core
- 25 growing rope within said mesh sock to provide an attachment area for said at least one support device. Said attachment area being substantially free from molluscs and ready for attachment of said at least one support device by said support device applying means.

- In yet a further practical embodiment said means for applying said at least one support
- 30 device includes at least one push arm. Said at least one push arm being adapted, in use, to engage at least one support device from said at least one slide and to push the same into engagement with said at least one elongate mollusc growing line relative to said attachment area provided by said at least one set of mating jaws. Preferably said push arm

is mechanically actuated by at least one ram means or any other suitable means able to drive said push arm.

5 It is preferred that said at least one support device is selected from one or more of the following group: a planar support plate, a disc-shaped support plate, a support structure incorporating a series of protrusions, a support structure incorporating a ring-like support area, a cage-like structure, and/or any suitable combination thereof. Each of said at least one support devices including any suitable attachment means that is able to facilitate attachment to said at least one elongate mollusc growing line.

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In yet a further aspect the present invention may also provide an apparatus for providing at least one elongate mollusc growing line having at least one support device attached thereto, said apparatus including: means for supplying at least one elongate sock for injection with molluscs; means for injecting said molluscs into said at least one elongate sock; and means
15 for driving said at least one elongate sock through said apparatus, wherein, in use, said injection means continually socks said molluscs into said at least one elongate sock as the same is conveyed by said driving means to provide said at least one elongate mollusc growing line; said apparatus further including: means for providing said at least one support device for attachment to said at least one elongate mollusc growing line; means for
20 releasably holding said at least one elongate mollusc growing line at a predefined location; and means for applying said at least one support device to said at least one elongate mollusc growing line whilst said at least one elongate mollusc growing line is held by said releasable holding means.

25 Preferably said apparatus for providing at least one elongate mollusc growing line having at least one support device attached thereto may include any one or more of the features defined above with respect to said apparatus for socking molluscs and/or said apparatus for attaching at least one support device to said at least one elongate mollusc growing line.

30 In a practical preferred embodiment said at least one elongate mollusc growing line, and/or said at least one elongate mollusc growing line having at least one support device attached thereto, of any one of the preceding paragraphs is adapted to be suspended below the surface of the water in order to provide an attachment surface or support for molluscs or the like during their growth. Said at least one support device being attachable to said at

least one elongate mollusc growing line at any fixed location. The body of said at least one support device being adapted to provide additional support area for said molluscs to attach to or be supported by as they grow.

5 In yet a further aspect the present invention may also provide a method for socking molluscs to provide at least one elongate mollusc growing line, said method including the steps of: supplying at least one elongate sock for injection with molluscs; injecting said molluscs into said at least one elongate sock; and conveying said at least one elongate sock simultaneously whilst said molluscs are injected into said at least one elongate sock to
10 produce said at least one elongate mollusc growing line.

In yet a further aspect the present invention may also provide a method for attaching at least one support device to at least one elongate mollusc growing line, said method including the steps of: supplying said at least one elongate mollusc growing line; providing
15 said at least one support device for attachment to said at least one elongate mollusc growing line; releasably holding said at least one elongate mollusc growing line at a predefined location; and applying said at least one support device to said at least one elongate mollusc growing line whilst said at least one elongate mollusc growing line is releasably held.

20 In yet a further aspect the present invention may also provide a method for providing at least one elongate mollusc growing line having at least one support device attached thereto, said method including the steps of: supplying at least one elongate sock for injection with molluscs; injecting said molluscs into said at least one elongate sock; and conveying said at
25 least one elongate sock simultaneously whilst said molluscs are injected into said at least one elongate sock to produce said at least one elongate mollusc growing line; said method further including the steps of: providing said at least one support device for attachment to said at least one elongate mollusc growing line; releasably holding said at least one elongate mollusc growing line at a predefined location; and applying said at least one
30 support device to said at least one elongate mollusc growing line whilst said at least one elongate mollusc growing line is releasably held.

In order that the invention may be more clearly understood and put into practical effect there shall now be described in detail preferred constructions of an apparatus for socking seed

molluscs and/or for applying support devices to growing lines used for cultivating molluscs in accordance with the invention. The ensuing description is given by way of non-limitative examples only and is with reference to the accompanying drawings, wherein:

Fig. 1a is a perspective view of a prior art socking applicator shown loaded with a mesh sock ready for use;

Fig. 1b is a cross-sectional perspective view of the socking applicator of Fig. 1, shown in use in a first mode of operation of socking seed mussels;

Fig. 1c is a cross-sectional perspective view of the socking applicator of Fig. 1, shown in use in a second mode of operation of socking seed mussels;

Fig. 2 is a perspective view of a mollusc culture growing arrangement showing a growing line suspended beneath the surface of the water in order to provide support for molluscs as they grow;

Fig. 3 is a perspective view of an apparatus for socking seed molluscs and/or for applying support devices to growing lines made in accordance with a first preferred embodiment of the invention, and suitable for providing a growing line for use in the mollusc growing arrangement shown in Fig. 2;

Fig. 4a is a cross-sectional view of the socking applicator of the apparatus of Fig. 3, shown being fitted to the apparatus;

Fig. 4b is a similar view to that of Fig. 4a, this time showing the socking applicator fitted to the apparatus of Fig. 3;

Fig. 5a is an enlarged partial view of the apparatus of Fig. 3, showing the support device application region of the apparatus in operation after having applied a support device and ready to apply a further support device;

Fig. 5b is a perspective view of one of the support devices circled in Fig. 5a, the subject of which is disclosed in Australian Patent Application No. 2003904988;

Fig. 5c is a similar view to that of Fig. 5a, showing the apparatus in a further mode of operation applying a further support device;

Fig. 5d is an enlarged view of the circled region of Fig. 5c;

Fig. 6a is a plan view of a support device disclosed in US Patent No. 6,578,523, of Gagnon, suitable for application by the apparatus of Fig. 3;

Fig. 6b is a side view of the support device of Fig. 6a;

Fig. 7a is a plan view of a support device disclosed in US Patent No. 6,520,116, of Jefferds, suitable for application by the apparatus of Fig. 3;

Fig. 7b is a plan view of the support device of Fig. 7a;

Fig. 8 is an enlarged perspective view of the support device application area of an apparatus for socking seed molluscs and/or for applying support devices to growing lines made in accordance with a second preferred embodiment of the invention, and suitable for providing the growing line of the mollusc growing arrangement shown in Fig. 2;

5 Fig. 9a is an enlarged view of the socking application region of the apparatus of Fig. 3 or Fig. 8;

Fig. 9b is an enlarged side view of the circled region of Fig. 9a;

Fig. 9c is an enlarged cross-sectional view of the circled region of Fig 9a;

10 Fig. 10a is a perspective view of a preferred embodiment of the drive wheel of the apparatus of Fig. 3;

Fig. 10b is a plan view of the drive wheel of Fig. 10a;

Fig. 10c is a side view of the drive wheel of Fig. 10a;

Fig. 10d is a cross-sectional view of the drive wheel of Fig. 10a, shown driving a growing line having a small diameter; and

15 Fig. 10e is a similar view to that of Fig. 10d, shown driving a growing line with a large diameter.

Referring now to the drawings, wherein like reference numerals correspond to like parts throughout, in Fig. 1a there is shown a prior art mussel socking applicator 10, having a tubular
20 body 12 defining a first and second tube opening 14,16. Applied in a stretched state to the outer surface of body 12 of socking applicator 10 is an elastic mesh sock 18. Mesh sock 18 is a net-like stocking and may be perishable if so desired depending on its application. In known methods of cultivating mussels, such as those described above, socking applicator 10 has traditionally been used in one of two ways in order to manually inject seed mussels
25 into mesh sock 18. In Fig. 1b there is shown a first mode of operation of socking applicator 10, being used to manually inject and sock seed mussels 20 into mesh sock 18. In this first mode of operation, mesh sock 18 has been drawn off an end of socking applicator 10, at second tube opening 16, and a knot 22 has been tied in mesh sock 18 to enclose the same ready for injection with mussels 20. In use, in this first mode of operation, the process of
30 socking mussels 20 into mesh sock 18 is achieved by manually injecting mussels 20 into socking applicator 10, through first tube opening 14 in the direction of arrows *a*. As mussels 20 are injected into socking applicator 10 they pass through socking applicator 10, out second tube opening 16 and into mesh sock 18 relative to the end enclosed by knot 22. The socking process is then continued by pulling more of mesh sock 18 away from socking applicator 10

in the direction of arrows *b*. The action of pulling mesh sock 18 away from socking applicator 10 is done simultaneously with the process of injecting mussels 20 into socking applicator 10 which ensures that mesh sock 18 is continually filled with mussels 20 as the same is pulled away from socking applicator 10. When mesh sock 18, socked with mussels 20, reaches a predefined length, or when mesh sock 18 has completely pulled away from socking applicator 10, the filled mesh sock becomes a growing line 24 that resembles a long sausage which is tied to enclose its open end and is later used for culturing mussels 20. If growing line 24 reaches a desired length before mesh sock 18 is completely pulled away from socking applicator 10, mesh sock 18 can be cut and then tied. Alternatively, if growing line 24 utilises all of loaded mesh sock 18 which has been completely pulled away from socking applicator 10, growing line 24 is simply tied ready for cultivation.

If desired, and as shown in the representations, growing line 24 may also include a core growing rope 26. Growing rope 26 provides additional support to mussels 20 for attachment as they grow and also strengthens overall growing line 24. If mesh sock 18 is perishable, growing rope 26 is essential to growing line 24 as when mesh sock 18 disintegrates only growing rope 26 remains. In use, growing rope 26 may be inserted into mesh sock 18 simultaneously with the process of injecting mussels 20 through first tube opening 14 of socking applicator 10. As mesh sock 18 is elastic the same will constrict around growing rope 26 and mussels 20 as growing line 24 is formed, ensuring that eventual growing line 24 is maintained. Alternatively, growing rope 26 may be inserted through socking applicator 10, before mussels 20 are injected, and may be tied together with mesh sock 18 to form knot 22.

A second mode of operation of socking applicator 10 is shown in Fig. 1c. In this alternate mode of operation, the process of forming growing line 24 is similar to that of the first mode of operation shown in Fig. 1b. However, here instead of mesh sock 18 being pulled away from the end of socking applicator 10 at second tube opening 16, mesh sock 18 has been pulled over and into first tube opening 14, and through socking applicator 10. In this mode of operation, growing line 24 is formed within socking applicator 10, meaning mussels 20 are socked internally of socking applicator 10. This process provides greater control over the density of mussels 20 within growing line 24. The overall density being limited to that of the internal diameter of socking applicator 10. In practice, if growing lines 24, with varying densities are required, more than one socking applicator 10 would be used. Each socking applicator 10 having different internal diameters.

In Fig. 2 there is shown a mollusc growing arrangement 28 suitable, for example, for growing mussels 20. Mollusc growing arrangement 28 includes a growing line 24 vertically suspended below the surface of the water 30 to provide a harvesting support media for mollusc cultivation. In practice a plurality of growing lines 24, commonly referred to as "droppers", are suspended below the surface of water 30 to provide a large cultivation area for mollusc growth. Growing line 24 is suspended from a substantially horizontal support line 32. Support line 32 is generally suspended beneath the water surface 30 between a pair of buoys (not shown). Vertical support lines (not shown) are usually attached to the buoys and are anchored to the seabed (not shown) in order to maintain the overall mollusc growing arrangement 28 at a chosen location.

As already discussed, growing line 24 may consists of growing rope 26 and mussels 20 which have been socked with mesh sock 18. Although shown in mollusc growing arrangement 28 as each including growing rope 26 and mesh sock 18, growing line 24 may be embodied as a growing rope 26 or mesh sock 18 used on their own. Similarly, growing line 24 may consist of one or more alternative growing media (not shown), used on their own or in combination, and as such the invention is not intended to be limited to any specific example shown.

A general discussion of mussel cultivation utilising vertically suspended growing lines has already been provided in the initial paragraphs of this specification and is herein incorporated with reference to the present discussion.

What is also shown attached to growing line 24 (Fig. 2) and positioned at spaced-apart locations thereon are a plurality of support devices 34. In mollusc growing arrangement 28, support devices 34 are embodied as skewers which provide additional support for mussels 20 to attach to, as they grow. In harvesting use, when support devices 34 are attached to growing line 24 and placed in the environment of mollusc growing arrangement 28, mussels 20 are not only able to attach themselves to other mussels 20, growing rope 26 and mesh sock 18, but can also attach themselves to support devices 34 for additional support. Support devices 34 provide horizontal support projections for mussels 20, that emanate from the vertically suspended growing line 24. This horizontal attachment of mussels 20 helps to reduce losses associated with the slide off effect.

In Figs. 1b & 1c, a single support device 34 is shown being applied to growing line 24 after a section thereof has been formed. In practice, if support device 34 is embodied as a skewer as shown, support device 34 is manually attached to growing line 24 by inserting the same through mesh sock 18 and core growing rope 26 in the direction of arrow c. A discussion of the traditional act of skewering a growing line 24 and the problems associated therewith has
5 already been provided in the initial paragraphs of this description and is incorporated herein with reference to the present discussion.

Although shown in Figs. 1b to 2 as being a skewer, it is to be understood that support devices
10 34 can be any suitable support means, such as those disclosed in US Patent Nos. 6,578,523 (Figs. 6a & 6b) and 6,520,116 (Figs. 7a & 7b), or any of the support devices disclosed in the present Applicant's own earlier Australian Patent Application No. 2003904988 (for example, the support device shown in Fig. 5b, which will be discussed in detail in the latter part of the present description with reference to the present invention). A discussion of each of the
15 abovementioned support devices and their benefits, application and/or limitations has already been provided.

Referring now to Fig. 3, wherein there is shown an apparatus 36 for socking seed molluscs, especially mussels 20, and/or for applying support devices 34 to growing lines 24 made in
20 accordance with a first preferred embodiment of the invention, and suitable for providing a growing line 24 for use in the mollusc growing arrangement 28 shown in Fig. 2. Apparatus 36 includes a generally rectangular frame 38 having a pair of top and bottom frame rails 40,42 and a pair of left and right frame rails 44,46. At the base of apparatus 36 is a pair of reinforcement plates 48,50 and a left side rail 52 and a right side rail (not shown) each secured
25 to respective left and right rails 44,46 and bottom rails 42 to provide rigid support for apparatus 36. Frame 38 also includes a right side reinforcement plate 54 secured to right rails 46 and a horizontal assembly support rail 56 attached at its ends 58,60 to respective reinforcement plates 48,50 by fasteners 62, for example, bolts with cooperating nuts, as
shown.

30 A large drive wheel 64, which is mechanically driven by any suitable means (not shown), is arranged between left rails 44 relative to their upper most points and above top rails 40. Drive wheel 64 rotates relative to its axle 66 which is connected to a pair of supports 68. Supports 68 are pivotally movable with respect to left rails 44 relative to a pair of support pivots 70.

Connected to respective supports 68, opposite axle 66, are springs 72, whose opposite ends are connected to respective left rails 44. The arrangement of drive wheel 64, axle 66, supports 68, pivots 70 and springs 72 is such that drive wheel 64 is spring tensioned to assist the operation of apparatus 36 relative to growing line 24 as the same is drawn through apparatus 36 by drive wheel 64. A discussion of the benefit of this tensioned spring arrangement will be provided later. However, it is to be understood that this spring tensioned arrangement of drive wheel 64 is not essential to the invention as the same or similar benefits (discussed later) can be achieved in many different ways, for example, means (not shown) separate from drive wheel 64 could provide the required spring tension relative to growing line 24.

Also included on apparatus 36 is a rope feed wheel 74 for feeding growing rope 26, and a pair of growing line guide wheels 76. Rope feed wheel 74 is pivotally connected to an upright frame extension 78 by a feed wheel pivot 80. Upright extension 78 protrudes and extends vertically upwards from one of top rails 40 and is secured to the same. Guide wheels 76 are pivotally connected to a movable applicator assembly 82 via guide wheel pivots 84.

The remaining components of apparatus 36 will now be discussed with reference to two distinct separate operational regions of apparatus 36, namely, the seed mollusc socking region and the support device 34 application region of apparatus 36. It is to be understood that although apparatus 36 is shown as including both of these two distinct regions in one unit, and hence both are able to be operated simultaneously, each of these regions as now will be described can be operated independently. Similarly, apparatus 36 may be embodied as only including one of the two distinct regions, meaning apparatus 36 could just be socking apparatus 36 or a support device application apparatus 36. The components as already defined being components that would be common to either apparatus if embodied as separate units.

The seed mollusc socking region of apparatus 36 shall now be described with reference to Figs. 3, 4a & 4b and 9c. In Fig. 3 there is shown a hopper 86 for supplying apparatus 36 with seed mussels 20. Hopper 86 includes an elongate slot-like opening 88 on its bottom edge which broadens at its left side to provide a larger opening therein. Hopper 86 is arranged above a conveyor 90 which is secured to top rails 40 of apparatus 36. In use, when conveyor 90 is driven by any suitable means (not shown), mussels 20 travel along conveyor 90 and out the left side of opening 88 in the direction of arrow *d* (Fig. 3). Mussels 20 then fall by

gravity, in the direction of arrows *e* (Figs. 3, 4b & 9a), into the broad end of a socking funnel 92 which is secured to top rails 40 by bolts 94. The narrow end of socking funnel 92 abuts against a sock feed flange 96 which is part of a removable tubular socking applicator 98. The arrangement of socking funnel 92 and flange 96 of socking applicator 98 is such that mussels
5 20 conveyed out of hopper 86, through opening 88, fall through socking funnel 92 and flange 96 and finally into socking applicator 98.

As best seen in Figs. 4a, 4b and 9c, removable socking applicator 98 includes a tubular outer body 100 which is adapted to receive a tubular insert 102, having a smaller diameter
10 than outer body 100. The downwardly extending opening in feed flange 96 is matched to the internal diameter of insert 102 to form a frictional join there between. Flange 96 is shaped such that when flange 96 is connected to insert 102 and insert 102 is positioned within outer body 100, flange 96 rests on outer body 100 to maintain insert 102 in position. Socking applicator 98, consisting of outer body 100, insert 102 and flange 96, constitutes a
15 separate removable entity as can be seen in Fig. 4a. When attached to apparatus 36, in the direction of arrow *f*, the end of outer body 100 of socking applicator 98 opposite flange 96 sits in a coupling 104 which has a downwardly extending skirt 106. Coupling 104 is movable in the direction of arrows *g* in order to provide ease of adaptation and removal of socking applicator 98. In use, when outer body 100 is loaded with mesh sock 18, or when
20 outer body 100 of socking applicator 98 requires re-loading with a new mesh sock 18, socking applicator 98 can either be adapted or removed with the assistance of coupling 104 by moving the same in the direction of arrows *g*.

The process of loading socking applicator 98 with mesh sock 18 ready for use first
25 involves the application of mesh sock 18 onto the external surface of outer body 100, as in the case of the prior art applicator 10 described above with reference to Figs. 1b & 1c. Where socking applicator 98 differs from prior art socking applicator 10 is the inclusion of insert 102 and the cooperating feed flange 96. In use, when applied to the present socking applicator 98, mesh sock 18 is required to pass over and through feed flange 96 and into
30 insert 102. The opening of mesh sock 18 is sealed by knot 22 and pushed into insert 102 ready for injection with growing rope 26 (if required) and seed mussels 20. When drawn through socking applicator 98, feed flange 96 provides a certain amount of resistance to the flow of mesh sock 18, which in turn provides tension to mesh sock 18 as the eventual growing line 24 is formed which assists the socking action. By including insert 102 the

varying density requirements of different socking actions, as described earlier, can be achieved in a novel manner. That is, only one outer body 100, loadable with mesh sock 18 is required to be adaptable with coupling 104 of apparatus 36. The single outer body 100 acts as a standardised cartridge for loading mesh sock 18, whereas more than one insert
5 102, each cooperating with a matching feed flange 96, can be used to provide the varying mussel density requirements. The required density being achieved by introducing into outer body 100 an insert 102 with a suitable internal diameter.

An additional movable restricting flange 108 is also depicted in the drawings. This
10 restricting flange 108 is preferably included to assist the socking action by providing added resistance to mesh sock 18. Restricting flange 108 works in conjunction with feed flange 96 in order to provide a predetermined amount of frictional tension against the action of mesh sock 18 as the same is drawn through socking applicator 98 after passing under
15 restricting flange 108. This frictional tension ensures that mesh sock 18 does not flow to freely during the socking action. Flange 108 can also be mechanically raised (if desired) in the direction of arrows *h* (Fig. 9c) so as to lock mesh sock 18 against the lower side of feed flange 96 when required in order to prevent mesh sock 18 displacement. This feature may be required when apparatus 36 is stopped for any reason.

20 The second distinct separate operational region of apparatus 36, namely the support device application region, shall now be described with reference to Figs. 3 and 5a to 5d. In Fig. 3 it can be seen that applicator assembly 82 of apparatus 36 is adapted to be movable with respect to a pair of guide rods 110. Guide rods 110 are arranged parallel to each other, one on top of the other, and extend between respective horizontal assembly support rail ends 58,60.

25 Applicator assembly 82 includes four guiding flanges 112, two associated with each guide rod 110, positioned on left and right sides of assembly 82, which receive respective guide rods 110 to facilitate left and right horizontal movement of applicator assembly 82 in the direction or arrows *i,j* (Figs. 5a & 5c). Applicator assembly 82 is biased to a rest position (Fig. 5a) in the direction of arrow *i* by a pair of springs 114. Springs 114 fit over and surround respective
30 guide rods 110 and extend from horizontal assembly support rail end 60 and act against the two right side guiding flanges 112 of applicator assembly 82. An assembly ram 116, actuated by any suitable means (not shown), connected to frame 38 at one end and to applicator assembly 82 via a support 118 at its other end, draws applicator assembly 82 to a working position (Fig. 5c) in the direction or arrow *j*. When the actuation force of assembly ram 116 is

released, springs 114 facilitate movement of applicator assembly 82 along guide rods 110 back to the rest position of Fig. 5a.

It is to be understood that although springs 114 are shown and used as the means in which applicator 82 is able to return to the rest position of Fig. 5a, other means (not shown) could be used to facilitate the same result. For example, a second assembly ram (not shown) could return applicator assembly 82 to the rest position, or similarly, assembly ram 116 could be embodied as a ram capable of working in both directions *i,j*, and as such the invention is not intended to be limited to the specific example as shown.

In order to facilitate simultaneous compression of mesh sock 18 around growing rope 26 and parting of mussels 20 within growing line 24, support device application region of apparatus 36 includes a first and second matched V-shaped jaw plate 120,124. First jaw plate 120 is arranged on and attached to a first jaw support 122 that is secured to applicator assembly 82 above right growing line guide wheel 76. Second jaw plate 124 is arranged on and attached to a second jaw support 126 that is secured to a vertical support plate 128 that is in turn attached to horizontal assembly support rail 56. The arrangement of jaw plates 120,124 is such that, in use, when growing line 24 is supplied to the support device application area of apparatus 36, movement of assembly 82 in the direction of arrow *j* (Fig. 5c) grabs growing line 24 within jaw plate 120 and moves the same into engagement with cooperating fixed jaw plate 124. As best seen in Fig. 5d, growing line 24 is then compressed within jaw plates 120,124 by further movement of applicator assembly 82 toward jaw plate 124 in the direction of arrow *j*. This compression of growing line 24 within jaw plates 120,124 simultaneously parts socked mussels 20 and constricts mesh sock 18 around core growing rope 26. This action of apparatus 36 provides an opportunity for attachment of a support device 34. That is, the jaw plates 120,124 of apparatus 36 provide a means of precisely locating and holding firm core growing rope 26 of growing line 24 ready for attachment of a support device 34.

Support devices 34 are provided to apparatus 36, ready for attachment, via a slide 130.

Slide 130 cooperates with jaw plate 124 and is inclined relative thereto with its upper loading end secured to right side reinforcement plate 54. When loaded in a cartridge type fashion into slide 130, support devices 34 are conveyed ready for application via a weight 132. It should be understood that although weight 132 is shown, support devices 34 could be conveyed in many other ways such as, for example, via the use of gravity or additional

means (not shown) such as a spring loaded mechanism, and as such the invention is not intended to be limited to the specific given. Slide 130 cooperates with jaw plate 124 via a pair of support device guide rails 134 which precisely convey support devices 34 out of slide 130 ready for application to growing line 24. As can be seen in Fig. 5a, support device guide rails 134 are lipped on their inner edges to define a recess 136 enclosed by jaw plate 124. Recess 136 cooperates with slide 130 to allow support devices 34 to travel out of slide 130 and towards the V-shaped periphery of jaw plate 124. Any suitable means (not shown) may be included to limit only one support device 34 from travelling out of slide 130 and onto jaw plate 124 ready for attachment to growing line 24. In use, once out of slide 130 and ready for attachment, support device 34 may be driven in the direction of arrow *k* (Fig. 5c) by a push arm 138 having a U-shaped periphery. Push arm 138 is seated between support device guide rails 134 and rests on jaw plate 124. Push arm 138 is actuated by a push arm ram 140 controlled by any suitable means (not shown), that is secured to frame 38 at one end and push arm 138 at its other end.

The overall operation of apparatus 36 facilitating socking of mussels 20 and attachment of support devices 34 to growing line 24, in one simultaneous action, shall now be described with reference to Figs. 3, 5a and 5c & 5d. In these drawings it can be seen that apparatus 36 is being utilised to attach the support device 34 of Fig. 5b. As explained previously, support device 34 of Fig. 5b is an embodiment of an earlier invention claimed in Australian Patent Application No. 2003904988 of the present Applicant. Support device 34 includes a body 142 having two angularly-disposed arm portions 144, 146 joined at an intersection portion 148. Defined between arm portions 144, 146 is an inwardly tapered slot 150, having opposed slot sides 152, 154 and an apex 156 positioned relative to intersection portion 148. In use, tapered slot 150 is adapted to receive and engage growing line 24 in order to facilitate attachment thereto. When growing line 24 is introduced into inwardly tapered slot 150 and forced towards apex 156, growing line 24 is wedged into engagement with opposed slot sides 152, 154, providing secure attachment of support device 34 to growing line 24. Support device 34 also includes a support portion 158 which includes a support skirt 160. Extending perpendicular to inwardly tapered slot 150 and joined to respective sides of skirt 160 is a growing rope engaging support 162. Rope engaging support 162 provides additional support to support device 34 when the same is attached to growing line 24 by pressing against growing line 24 towards core growing rope 26. This additional support provided by rope engaging support 162 assists against pivotal movement of support device 34 relative to

growing line 24 when the same is exposed to mollusc growing arrangement 28. In use, and when attached to growing line 24, both body 142 and support portion 158 provide additional support area for mussel attachment to that provided by growing line 24.

5 To begin the overall operation, loaded mesh sock 18 is drawn away from socking applicator 98, over feed flange 96 and a knot 22 is tied in mesh sock 18 to enclose an end thereof. The knotted end 22 is then fed into insert 102 ready for injection with mussels 20. Growing rope 26, supplied via rope feed wheel 74, is then fed into the enclosed mesh sock 18. Seed mussels 20, loaded into hopper 86, are then supplied to enclosed mesh sock 18
10 containing growing rope 26 in the direction of arrows *d,e* via conveyor 90, through opening 88 and socking funnel 92. The now partially formed growing line 24 is drawn through insert 102 to continue the socking process. As growing line 24 comes out of insert 102 of socking applicator 98, past coupling 104, applicator assembly 82 is activated to draw the same toward fixed jaw plate 124 in the direction of arrow *j*. As assembly 82 is
15 drawn toward jaw plate 124, jaw plate 120 engages growing line 24 and carries the same into engagement with cooperating jaw plate 124. Skirt 106 of coupling 104 assists growing line 24 as the same is drawn out of socking applicator 98 and forced toward second jaw plate 124. When jaw plates 120,124 are fully engaged and growing line 24 is firmly held in the manner as discussed above, push arm 138 is activated and driven in the
20 direction of arrow *k* in order to push support device 34 into engagement with the compressed region of growing line 24 to attach the same to growing line 24. Support device 34 being ready for attachment having travelled off slide 130 and onto jaw plate 124 in cooperation with recess 136. Support device 34 being driven by force applied by the U-shaped periphery of push arm 138 against a matched shaped intersecting portion 148 of
25 support device 34. When driven fully into engagement with growing line 24, inwardly tapered slot 150 of support device 34 compresses mesh sock 18 about growing rope 26 and wedges support device 34 into engagement with opposed slot sides 152,154 at or near apex 156. This wedged engagement facilitates attachment of support device 34 at a fixed location on growing line 24. Push arm 138 is then retracted opposite the direction of arrow
30 *k* and the working action applied to applicator assembly 82 by ram 116 is released, retracting applicator assembly to its rest position against the action of springs 114. This brings the operation of apparatus 36 to the stage shown in Fig. 5a, wherein a support device 34 is now securely attached to growing line 24 and a further support device 34 has moved into position on second jaw plate 124 ready for application.

As the process of socking mussels 20 continues through the use of socking applicator 98, and further support devices 34 are applied in the manner as previously described (and as shown in Fig. 5c), growing line 24, having support devices 34 attached thereto, is drawn by
5 drive wheel 64 with the assistance of guide wheels 76. Coming off drive wheel 64 is finished growing line 24 which resembles a continuous line of sausages being separated by support devices 34 (Fig. 3). Growing line 24 now being ready for application in mollusc growing arrangement 28 or the like in any suitable manner, ie. cut to required lengths or hung as one long-line looped up and down throughout the growing environment.

10 The continual and precise operation of apparatus 36 is achieved through the use of a control means (not shown) and a series of sensors or the like (not shown) which monitor distances and various stages of operation of apparatus 36. The control means being able to actuate drive wheel 64, rams 116,140 and to control the supply of mussels 20 through the
15 use of conveyor 90.

As previously discussed, it is to be understood that the support device application region of apparatus 36 could be adapted to be able to apply the known support devices of Figs. 6a to 7b. The clip arrangement 164 of disc-shaped support device 34 of Figs. 6a & 6b could
20 attached to growing line 24 by the action of a suitably shaped push arm 138. When pushed toward and into engagement with growing line 24, growing line 24 would be required to transverse generally C-shaped slot 166 of support device 34 and into engagement with clip 164. Similarly, support device 34 of Figs. 7a & 7b would require suitable force applied by
25 push arm 138 in order to skewer growing line 24 with support projection 168 arranged within C-shaped slot 170, to facilitate attachment with growing line 24 in the centre of support device 34. If required to apply devices such as those shown in Figs. 6a to 7b, apparatus 36 could be adapted to include a substantially vertical slide or stacking arrangement such that support devices 34 would be supplied to push arm 138
perpendicular to jaw plate 124.

30 An apparatus 36 for socking seed molluscs, especially mussels 20, and/or for applying support devices 34 to growing lines 24 made in accordance with a second preferred embodiment of the invention is shown in Fig. 8. This apparatus 36 also being suitable for providing a growing line 24 for use in the mollusc growing arrangement 28 shown in Fig. 2.

In this embodiment only the support device application region of apparatus 36 is shown. It is to be understood that this device may also include the same or similar mussel socking region as described with reference to the previous embodiment. The support device application region of apparatus 34 this time is designed to facilitate application of support devices 34 embodied as skewers. Instead of having slide 130, apparatus 36 includes a hopper 172 loaded with a plurality of skewers 34. Hopper 172 cooperates with a skewer application barrel (not shown) arranged at the base of hopper 172 which is supplied by gravity with a single skewer 34 from within hopper 172. A push arm 138 is adapted by any suitable means, such as, for example, via a ram (not shown), to push the skewer 34 loaded in the application barrel through the same and into and through core growing rope 26 or growing line 24. A movable jaw 120 is adapted to be driven in the direction of arrow 1 towards and into engagement with a fixed jaw 124. The arrangement of jaws 120,124 is such that growing line 24 is compressed and held in a similar manner to that described above with reference to the preceding embodiment. An exit point of the barrel (not shown) is located between jaws 120,124 when the same are in engagement. When jaws 120,124 are driven fully into engagement in the direction of arrow 1, and growing line 24 is held in the desired manner, push arm 138 is actuated in order to drive skewer 34 within the barrel out of the barrel exit point and through growing line 24. It is preferable that part of the now engaged skewer 34 remains in the barrel until after movable jaw 120 is retracted. At this point push arm 138 can be reactivated to push the remaining portion of skewer 34 out of the barrel. Thus permitting complete disengagement of skewer 34 from the barrel of the application region of apparatus 36. Push arm 138 then returns to its rest position, by any suitable means such as springs (not shown) or the like, permitting a further skewer 34 to drop into the barrel ready for application.

Ideally when mechanically socking mussels 20 and/or applying support devices 34 with apparatus 34 of either embodiment above, growing rope 26 and/or mesh sock 18 need to be provided to apparatus 36 in a continuous form. Growing ropes 26, for example, could be joined together before entering the mussel socking region of apparatus 36 by a joining device 174 such as that shown in Fig. 9a and in enlarged view in Fig. 9b. Joining device 174 being adapted to join separate lengths of growing rope 26 prior to socking mussels 20. If joining device 174 is utilised during the socking action, once the entire operation is completed by apparatus 36 and hence growing line 24 is formed, prior to hanging growing lines 24 in growing arrangement 28, separation of growing lines 24 could occur by cutting

or tearing mesh sock 18 at the join relative to joining device 174. The now exposed joining device 174 could then be removed prior to tying growing line 24 to horizontal support line 32.

5 In a practical sense in any embodiment of apparatus 36 it is important that drive wheel 64 is able to securely engage growing line 24 to drive the same through apparatus 36. Growing line 24 should not be permitted to slip when engaged with drive wheel 64 when drive wheel 64 is rotating. When stationary, growing line 24 should be easily disengaged from drive wheel 64 to release growing line 24 when required. A preferred embodiment of
10 drive wheel 64 is shown in Figs. 10a to 10e. As can be seen in Fig. 10a, when adapted with apparatus 36, drive wheel 64 rotates in the direction of arrow *m*. Drive wheel 64 includes a series of paired upwardly projecting ridges 176 at its periphery. These ridges 176 define between matched pairs a generally V-shaped recess 178 having an appropriate angle α , for example 45 degrees. The specific choice of angle α depending on the mode of use of drive
15 wheel 64 of apparatus 36. Referring to Figs. 10d & 10e, it can be seen that V-shaped recess 178 of drive wheel 64 should be able to accommodate growing lines 24 of varying diameters, for example, apparatus 36 may be initially required to draw only growing rope 26 via drive wheel 64 (Fig. 10d), and later after the socking and support device application process has commenced, be able to drive socked growing line 24 (Fig. 10e). To assist in
20 grabbing and driving growing line 24, ridges 176 of drive wheel 64 can include tapered front faces 180. Front faces 180 of ridges 176 being oriented to the drive direction *m* of drive wheel 64. Front faces 180 can be tapered at an angle β , for example 30 degrees, and can also be inclined relative to the periphery of ridges 176 to provide in combination with tapered faces 180 a grabbing force on growing line 24.

25 The grabbing force achieved by the drive wheel as embodied in Figs. 10a to 10e, together with the spring tension arrangement of drive wheel 64 in Fig. 3 ensures that the overhanging and yet unseparated finished growing line 24 provides a resistance to slip and ensures forward movement of growing line 24 which is required by apparatus 36 to
30 facilitate the socking and support device application actions. The spring tension arrangement of drive wheel 64 also provides a required amount of release tension on growing line 24 when jaws 120,124 release after applying a support device 34. This tension occurs naturally as growing line 24 is halted from travel temporarily by the action of jaws 120,124. When jaws 120,124 release, springs 72, attached to supports 68

associated with drive wheel 64, release built up tension and urge growing line out of support device application region relative to jaws 120,124 and back into motion.

5 It should be understood that although the application process of apparatus 36 has been shown with respect to a vertically arranged growing line 24, the socking and/or support device application regions of apparatus 36 could be adapted to sock mussels 20 and/or apply support devices 34 to a growing line 24 oriented horizontally. In this alternate mode of operation (not shown) a support tray may be required for conveying the growing line. This support tray could be slotted so as to permit the raising of a lower jaw plate from
10 underneath the tray. This act could lift the growing line off the tray at that point toward an cooperating jaw located above the tray. The application of a support device could thereby occur by applying force to an appropriately positioned push arm cooperating with supplied support devices. Appropriate means in cooperation with the push arm could engage the support device, releases it from a cartridge type arrangement and convey it to the core
15 growing rope of the growing line to facilitate attachment thereof. The lower jaw plate would then be retracted, allowing the growing line with an attached support device to return to a rest position on the support tray. The support tray could be designed, if required, to slide away from the work area of the jaw plates to facilitate the removal of the growing line from the tray, for example, by inducing the tray to tip at a given point.

20

It should also be understood that as support device 34 of Fig. 5b is designed in a novel manner that enables itself to be easily attached to a growing line, as described in the initial paragraphs of this description, second jaw plate 124 may not require a V-shaped periphery. Instead, support device 34 may be conveyed partially over the edge of plate 124
25 such that inwardly tapered slot 150 of support device 34 could act as the second V-shaped jaw required to facilitate the parting and compressing action relative to growing line 24. Accordingly, second jaw plate 124 of the first embodiment of the accompanying representation is not essential to the invention if apparatus 36 is used in conjunction with an appropriately designed support device 34 of the present Applicant's own earlier
30 Australian Patent Application No. 2003904988.

Although not shown in the drawings, if a support device 34 used with apparatus 36 requires a larger constricted area of growing line 24 for attachment thereto, means (not shown) could be included to draw jaw plates 120,124 vertically apart after engagement of

the same, exposing a larger area of growing line 24 that has been freed of mussels 20 and constricted to locate growing rope 26. Such a support device 34 could then be attached to growing line 24 between the two parted jaw plates.

5 Although only specific examples of suitable support devices 34 and their application have been described, it is to be understood that many other support devices, each including means suitable for attachment to growing lines 24 could be applied with the apparatus of the present invention. Similarly, it is to be understood that the adaptation of support devices 34 with apparatus 36 is not intended to be limited to use in the mussel cultivation
10 area alone. Accordingly, support devices for other areas of aquaculture, for example, scallop, fish or oyster cultivation, could be applied by apparatus 36.

The present invention therefore provides a useful solution to problems previously discussed in relation to the manual actions of socking mussels and applying support devices to socked
15 growing lines, including the conventional skewer, the Applicant's own support device and those employed in the prior art. The invention solves the inherent problems associated with manual socking and application of mussels and support devices and the limitations stated relating thereto. The insert 102 of socking applicator 98 of apparatus 36 provides a novel means of achieving varying mussel density requirements, whilst the jaws 120,124 of the
20 support device application region of apparatus 36 make it possible to automate the application process of many support devices 34. Jaws 120,124 ensure correct alignment of growing line 24 whilst facilitating constriction of mesh sock 18 around core growing rope 26 which provides the required secure attachment area for support devices 34.

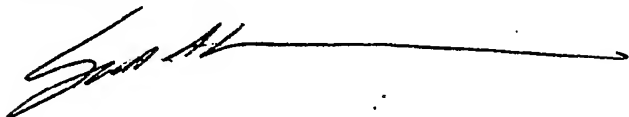
25 The invention will be understood to embrace many further modifications as will be readily apparent to persons skilled in the art and which will be deemed to reside within the broad scope and ambit of the invention, there having been set forth herein only the broad nature of the invention and certain specific embodiments by way of example.

30 Dated this 20th day of February, 2004.

PETER KVIETELAITIS

By his Patent Attorneys:

CALLINAN LAWRIE



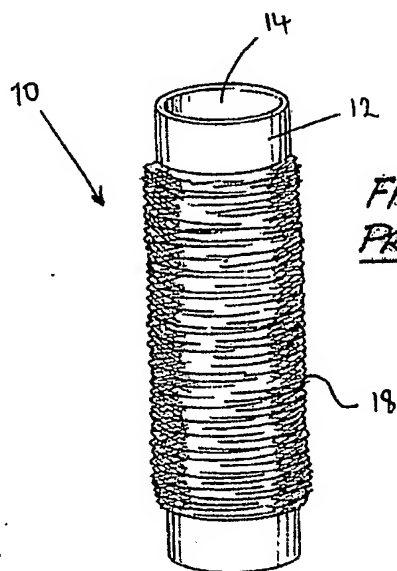


FIG. 1a
PRIOR ART

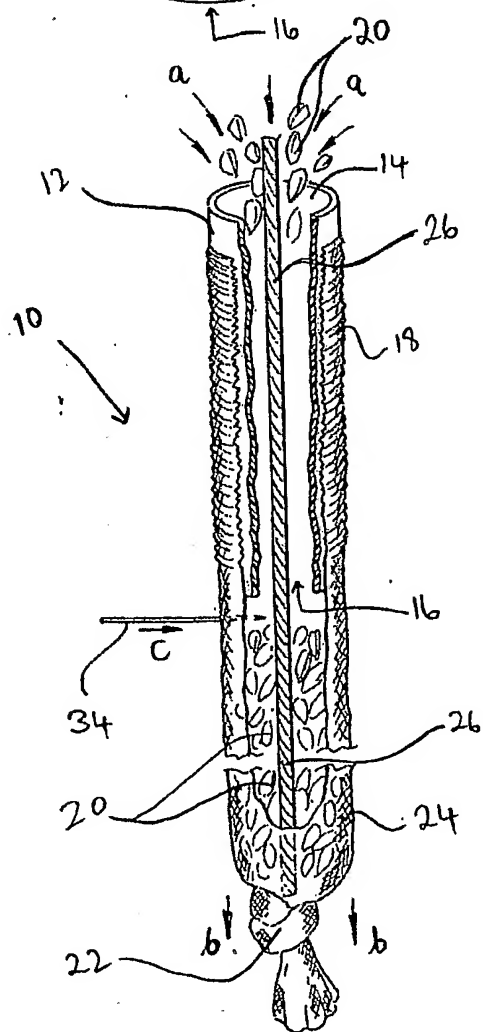


FIG. 1b PRIOR ART

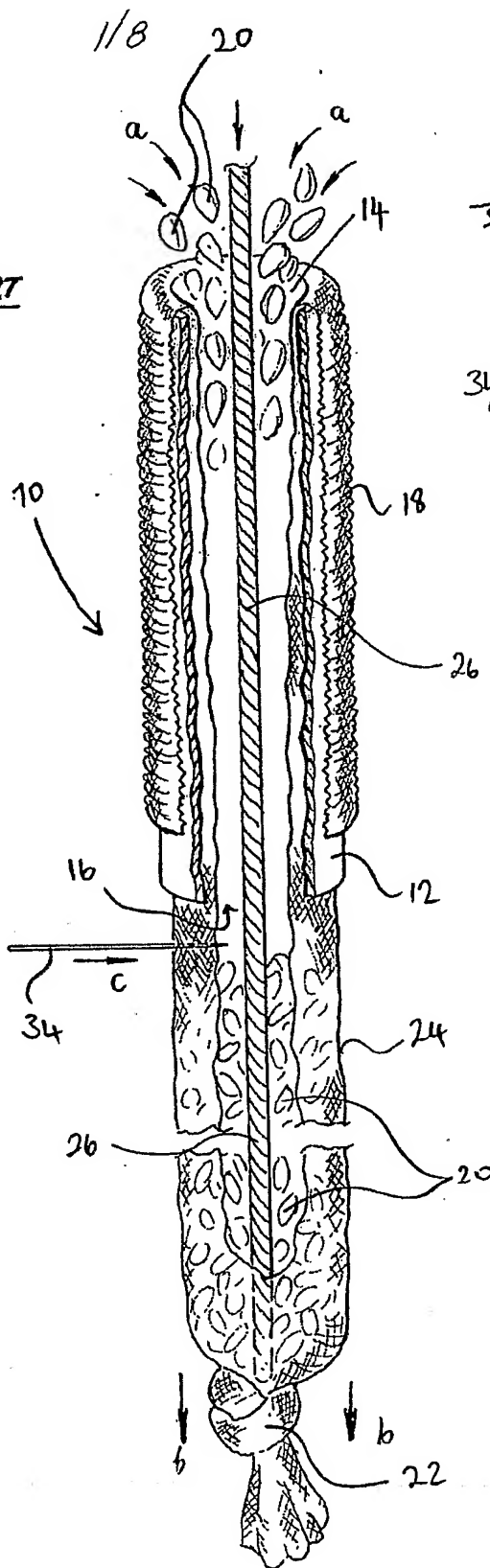


FIG. 1c PRIOR ART

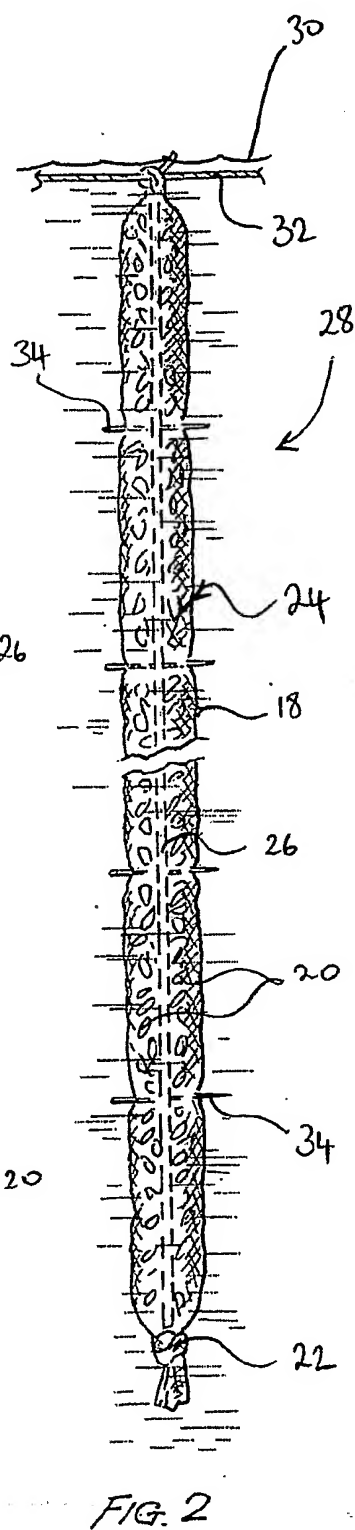


FIG. 2

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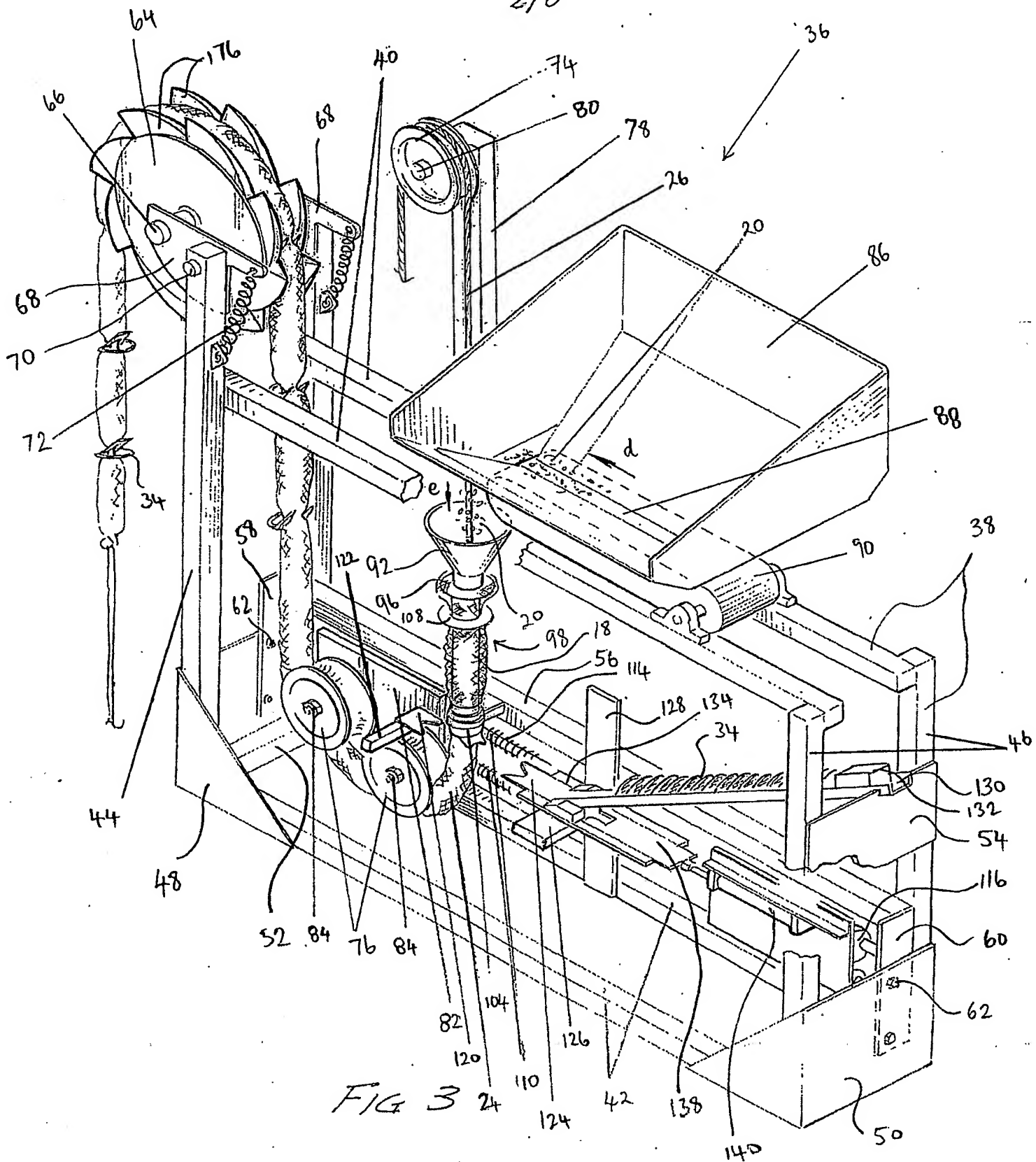


FIG 3

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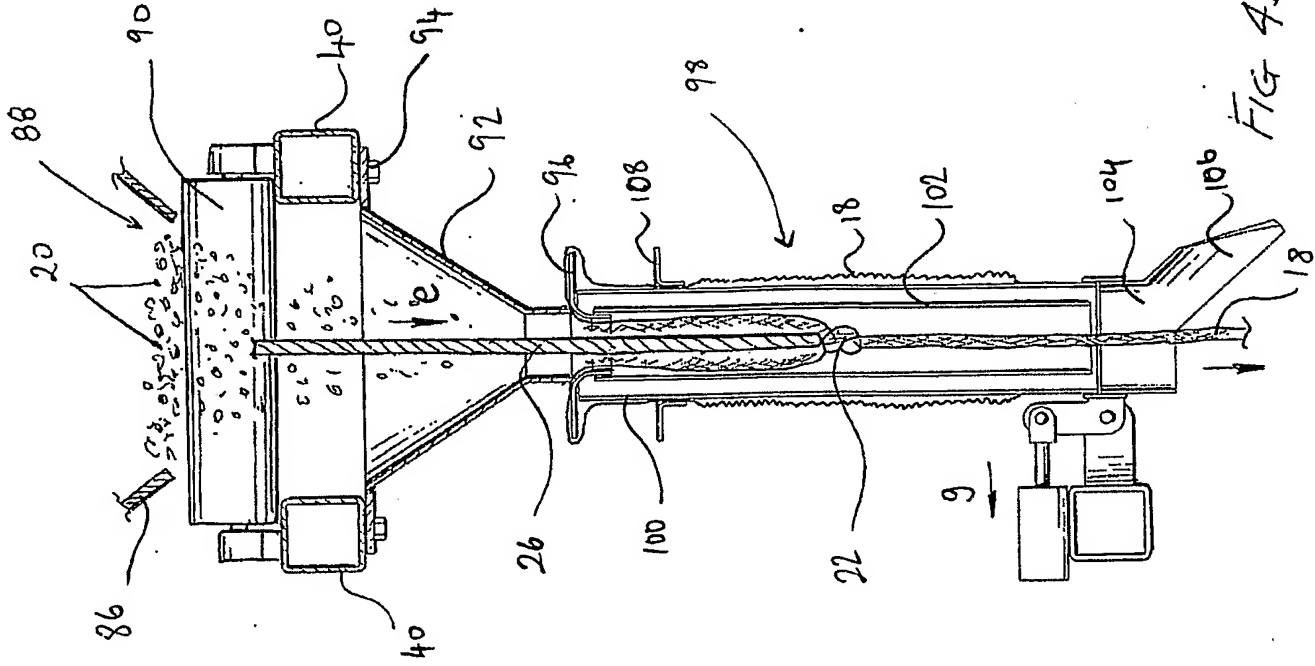


FIG 4b.

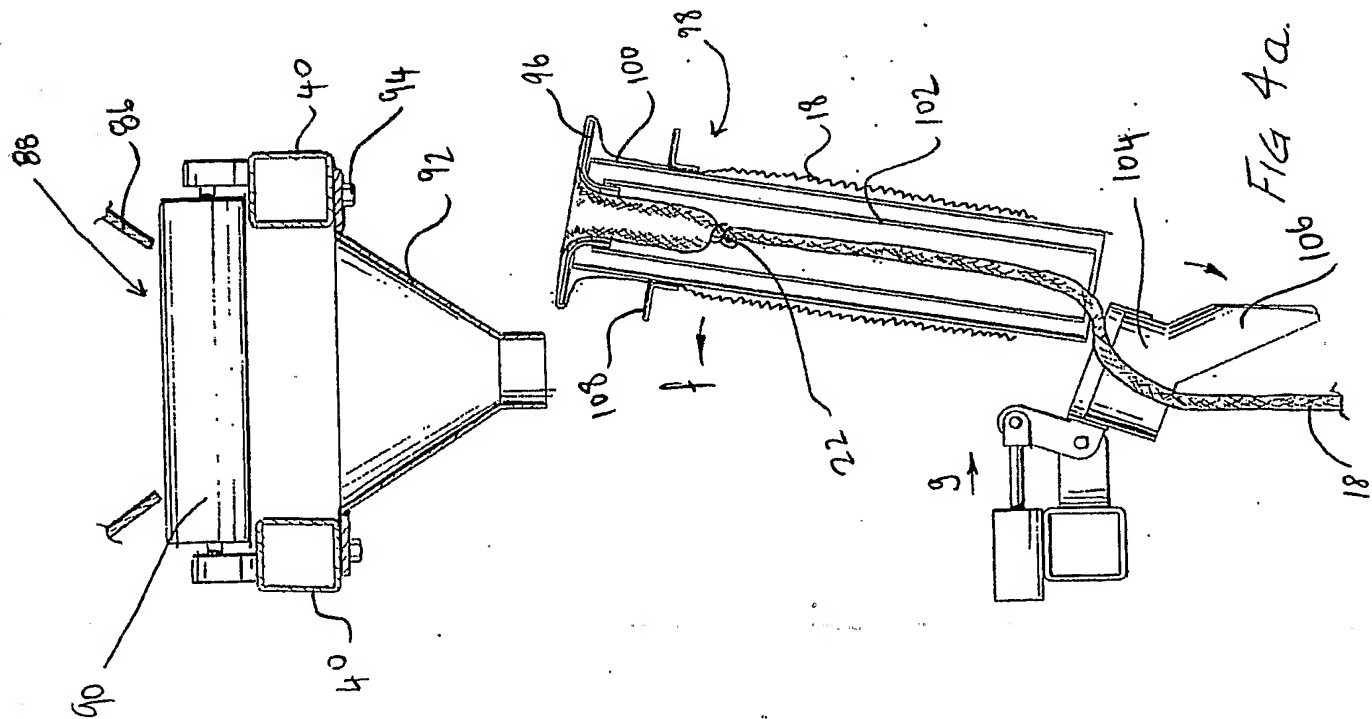


FIG 4a.

36

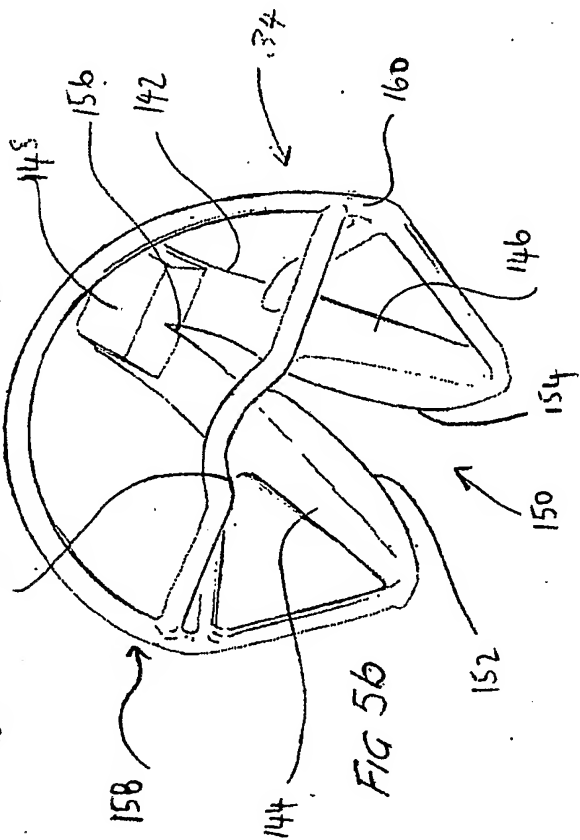
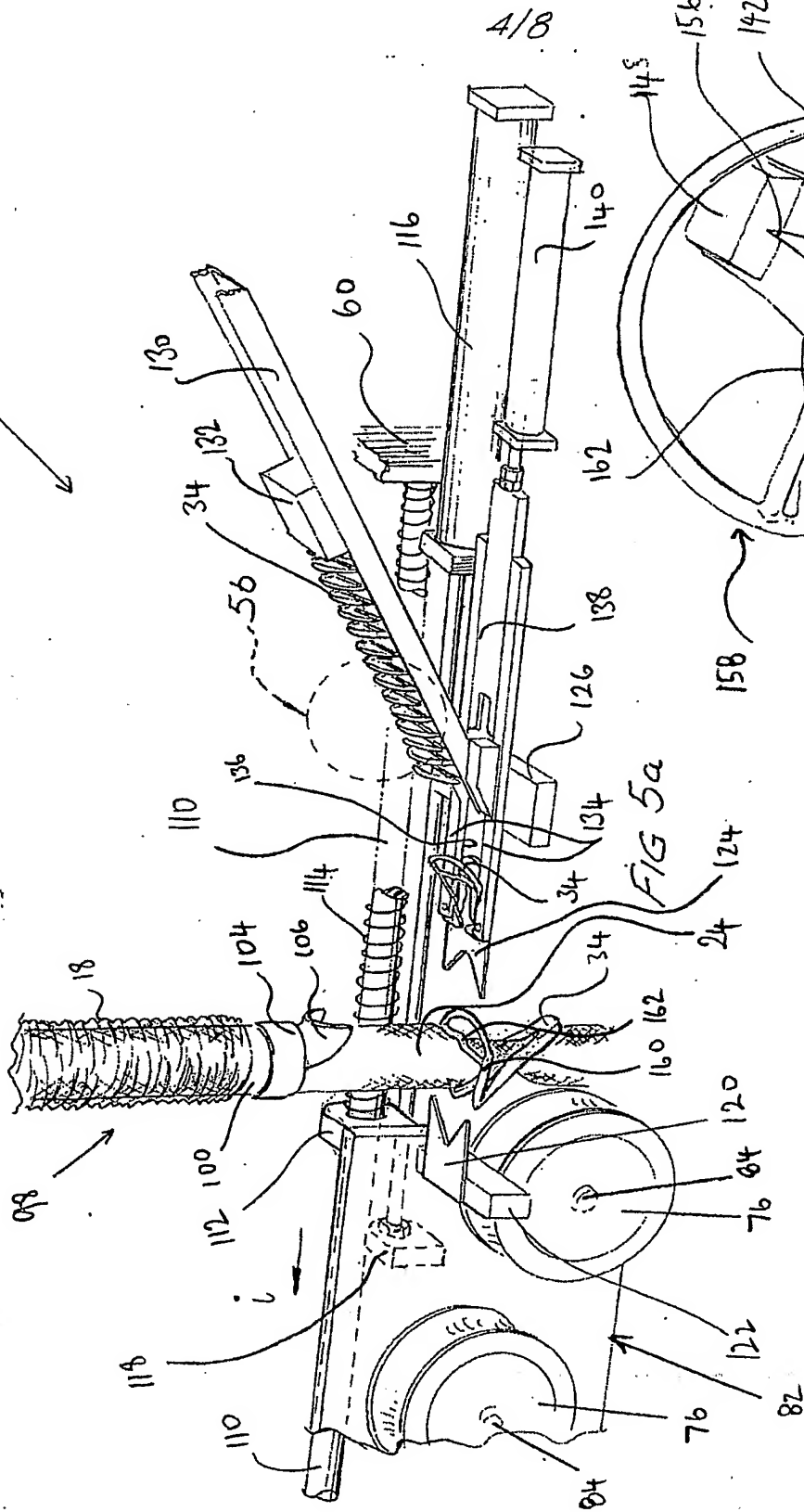


FIG 5a

FIG 5b

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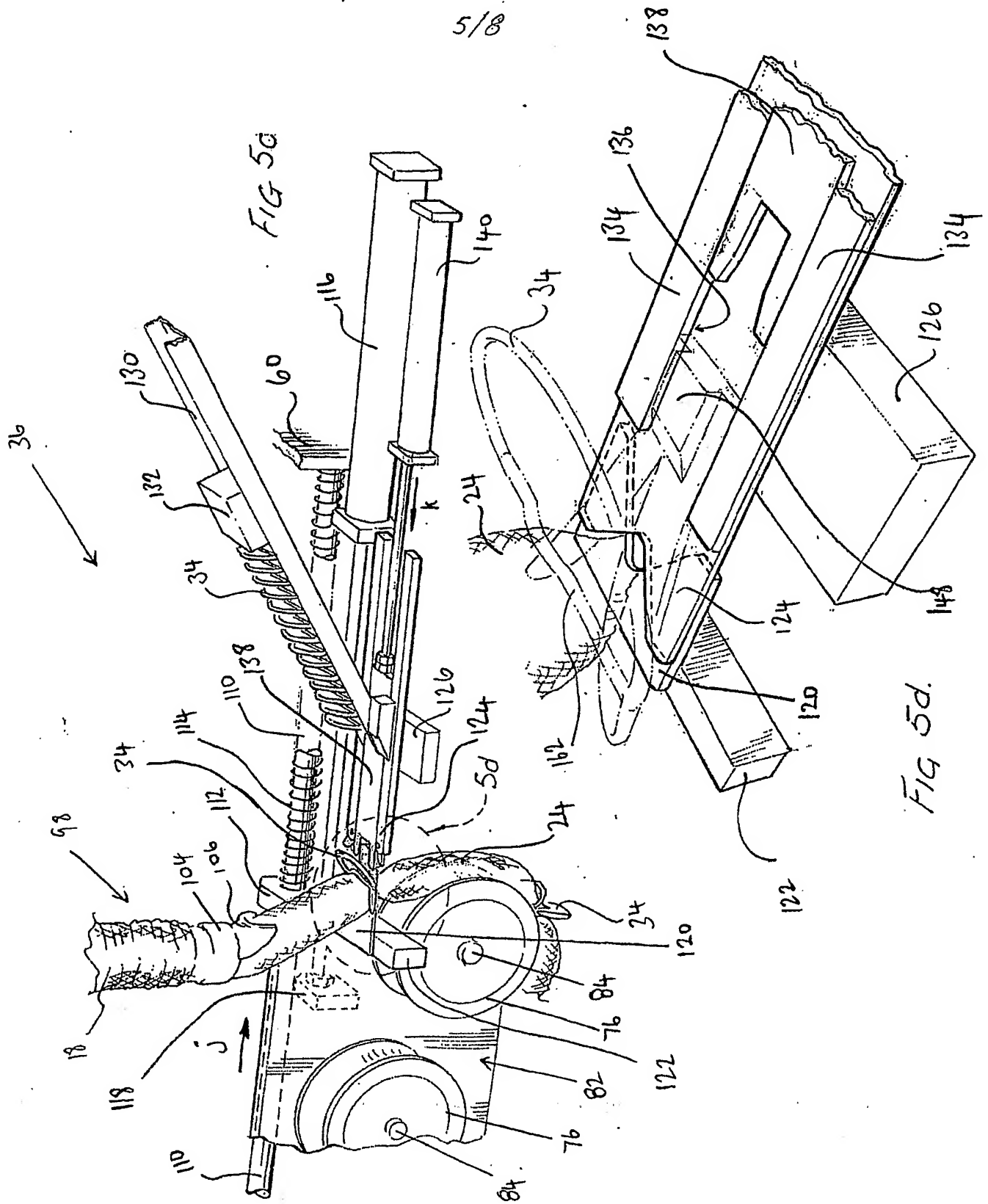


FIG 5c

FIG 5d.

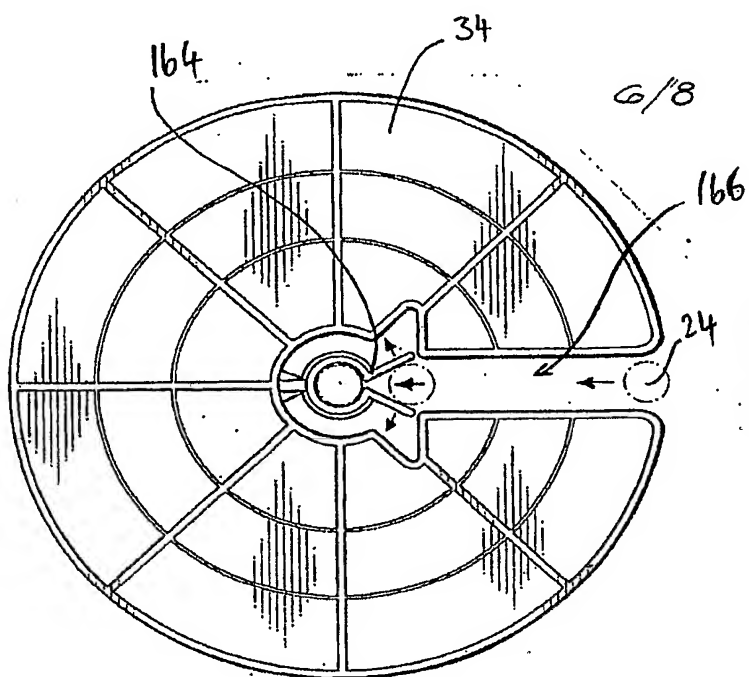


FIG 6a

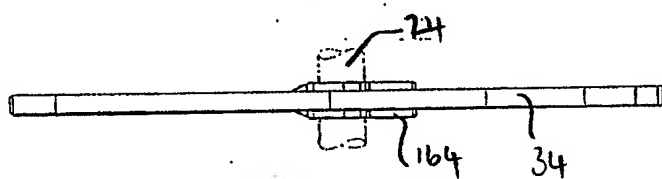


FIG 6b

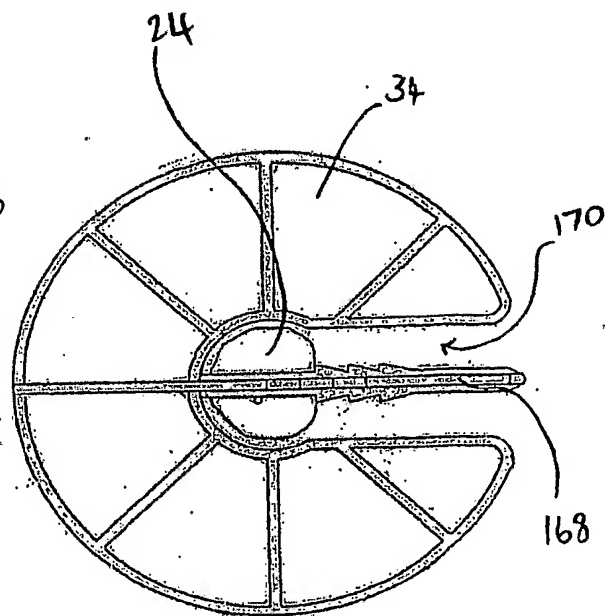


FIG 7a

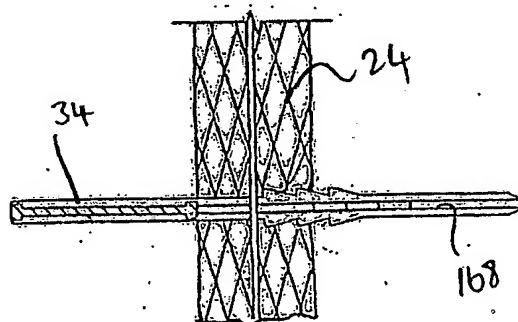


FIG 7b

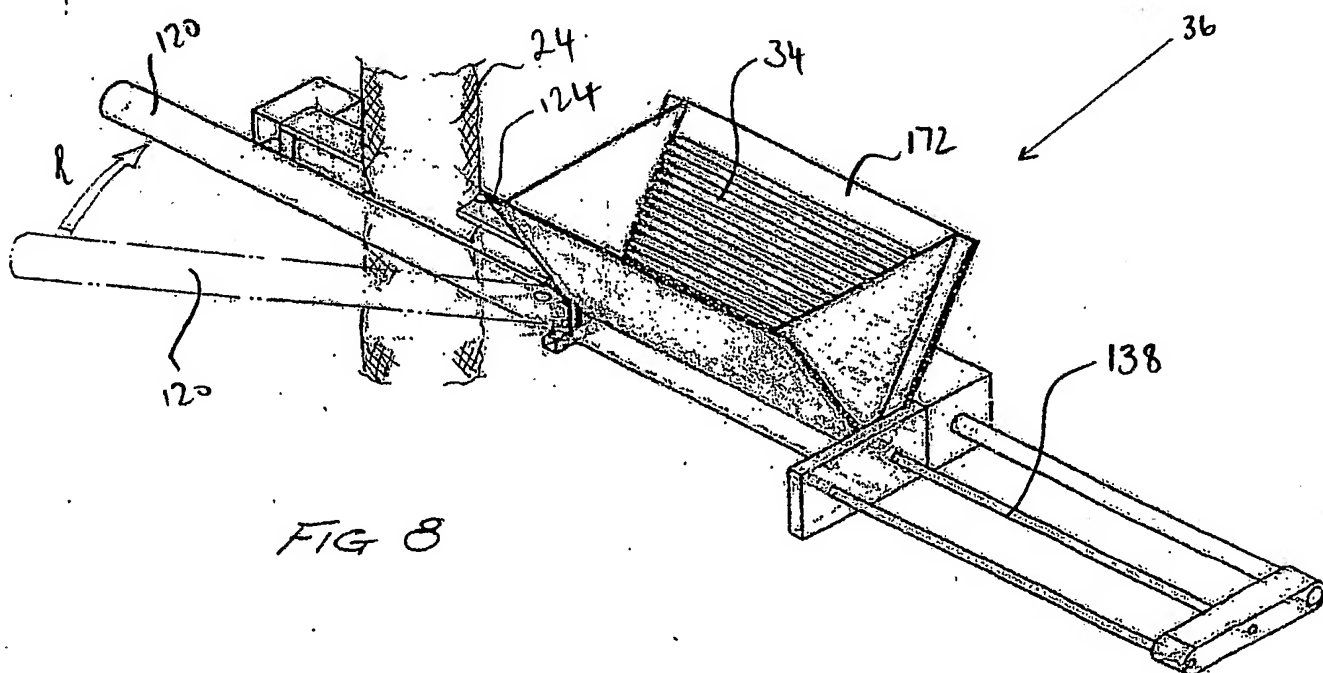


FIG 8

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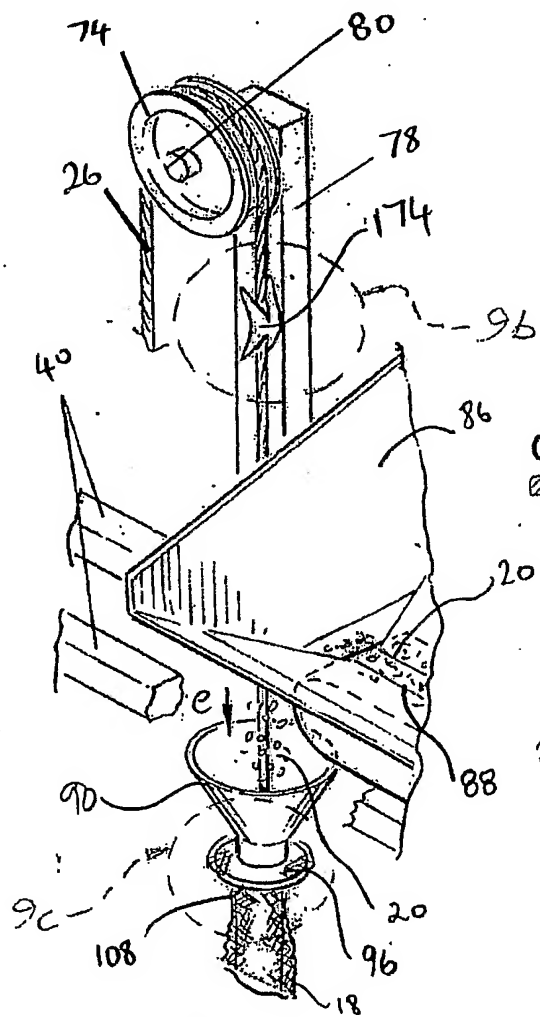


FIG 9a

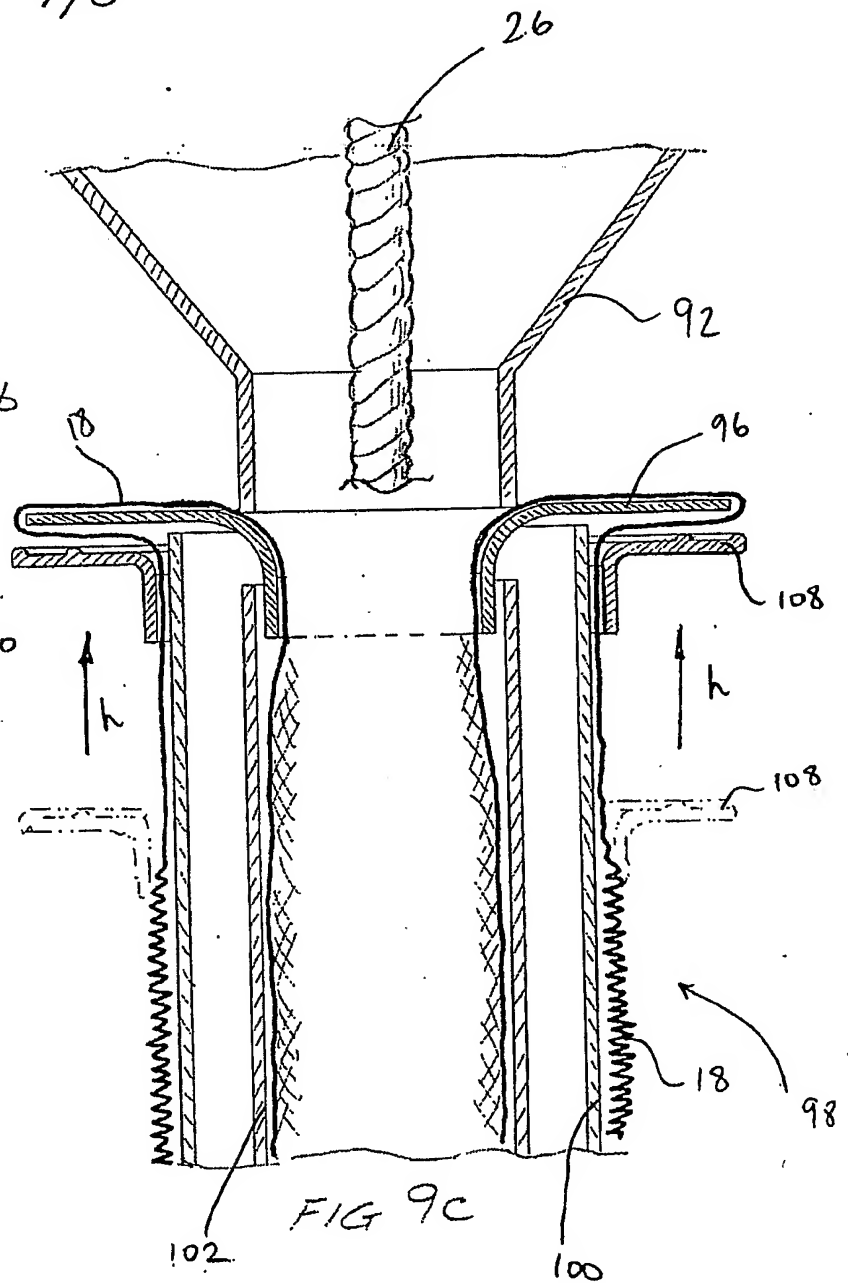


FIG 9c

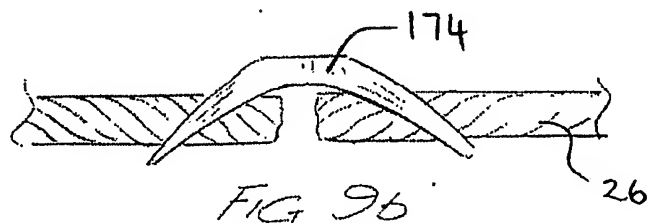


FIG 9b

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